EARTH ROTATION PARAMETERS FROM DSN VLBI: 1998

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The DSN's program of telemetered VLBI measurements of earth orientation concluded with a final observing session on September 30, 1997. The function of the telemetered sessions has been essentially assumed by earth orientation measurements based on observations of the satellites of the Global Positioning System.

NASA's Deep Space Network (DSN) operates radio telescopes for the primary purpose of communicating with interplanetary spacecraft. The DSN has three complexes: in California, in Spain, and in Australia. The Time and Earth Motion Precision Observations (TEMPO) project used the DSN telescopes to make rapid turnaround VLBI measurements of station clock synchronization and earth orientation in support of spacecraft navigation, which needs extremely timely, moderate accuracy earth rotation information. In TEMPO observations the raw bit streams recorded at the telescopes were telemetered to JPL for correlation, so that no physical transportation of magnetic tapes was involved. The DSN nominally scheduled two TEMPO observing sessions per week, one on the Spain-California baseline, and the other on the Australia-California baseline. Each session was generally 3 hours in duration (occasionally less), and recorded a maximum of 20 sources.

TEMPO VLBI measurements were intended to support near-real-time knowledge of earth orientation. At JPL, the TEMPO VLBI results were combined with other data about the earth's rotation, to provide near-real-time values and short term predictions of earth orientation, primarily for use in spacecraft navigation. The software used at JPL for combining various earth orientation measurements is called the Kalman Earth Orientation Filter (KEOF) (see: Freedman, A.P., Steppe, J.A., Dickey, J.O., Eubanks, T.M., and Sung, L-Y., The Short-Term Prediction of Universal Time and Length-of-Day Using Atmospheric Angular Momentum, J. Geophys. Res., 99, 6981-6996, April 10, 1994). An upgrade of the KEOF allowing it to utilize Length of Day measurements from the GPS system went into operational use on September 23, 1997. With the availability of daily earth orientation values from GPS with a turnaround time of one to two days, and with the ability to use them in the KEOF, the telemetered VLBI series was no longer necessary.

During calendar year 1997, the TEMPO project produced earth rotation measurements from 69 dual frequency observing sessions, with a median turnaround time, from observation to availability of earth orientation parameters, of 53 hours. The telemetered VLBI measurements were an important contributor to the accurate earth orientation series that enabled the successful navigation of the Mars Pathfinder landing in July 1997.

A description of the DSN VLBI data set and of most aspects of the data analysis can be found in IERS Technical Note 17, pp. R-19 to R-32 (see also IERS Technical Note 19, pp. R-21 to R-27).

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